in a nest with young found last season in a cave, one of the parents was white and the other blue.

11. Pelecanus conspicillatus. (*Australian Pelican.*)

About a dozen pairs of these birds nested on the Penguin Rocks on a small patch of clear ground just above high-water mark, and surrounded with high tussocky grass. The nests were very simple: a few sticks and bits of grass put together and almost level with the ground. There were one or two eggs or young in the nests, the latter being of various ages, from about three weeks old downwards. One little one, about three days old, managed in the absence of its parents to crawl from its rightful nest into that of its neighbour, which contained a bird about three weeks old. The elder bird immediately commenced vigorously pecking the little stranger, and would soon have killed it had the latter not been removed.

The young had no down on and their skin was bare; the regular lines of growth where the young feathers were appearing were plainly discernible. When they crawl they appear to stick their beaks into the soft soil and thus to pull themselves along, as they have not power to stand up and walk.

There appears to be some little time between the hatchings of the eggs in the same clutch, as one young bird was noticed being hatched while its companion was about seven days old; and in a clutch of two eggs taken, one was about five days more incubated than the other. Two eggs measured:—(1) 3·66 inches × 2·24; (2) 3·67 × 2·25.

XXXIV.—*On the Effect of Westerly Winds on the Flight of Gulls* (Laridæ) *and other Birds.* By J. H. Gurney.

In all birds it appears that wind, or the force of wind, is the prime mover in flight—that is to say, the action of the wings is greatly regulated by the direction and velocity of the wind, though, joined to this, the actual motive power is gravitation to the earth's surface. If there is absolutely no

wind a bird cannot fly its fastest; its flight is, on the contrary, often somewhat listless, and locomotion probably becomes laborious. It follows that it is easier for a bird to make headway where there is some slight opposition—to fly against a gentle wind rather than with it. The truth of this hypothesis has not been recognized by many writers, but it may be especially tested on the coast of Norfolk. This juts out into the North Sea like a great rounded peninsula, and just in the middle of the bend lies the little town of Cromer, where, or in its neighbourhood, most of the following observations have been made. From its position Cromer is peculiarly adapted for watching the direction and effect of wind and all the autumnal migratory movements of the lower-flying birds, so many of which come in from the sea or shoot down from the clouds, but in either case make land hereabouts.

Readers of the veteran Herr Gätke's 'Heligoland,' recently translated into English and edited by Mr. Harvie-Brown, will observe the importance which is attached at that ornithological observatory by the author to wind in its bearing on migration, especially in the 5th chapter, "On Meteorological Conditions which influence Migration." He sums up the result of continued personal observation by saying:—"Whereas birds appear in great number when the wind is in a particular direction, they are scarcely seen at all when it is in some other quarter" (p. 74). The particular direction which suits Heligoland may not by any means be the one which brings them to Norfolk. The number of remarkable migrations to Norfolk and the east coast of England generally, which have had no simultaneous counterpart in Heligoland, is very large indeed; therefore there is not that similarity between the two places which some have supposed. In the same way there have been many migrations to Heligoland which could not be correlated with any in England. For instance in October 1870 there were thousands of the Great Tit (*Parus major*) in Heligoland; in 1874 enormous numbers of Shore-Larks (*Otocorys alpestris*); in 1876 tens of thousands of Sky-Larks

(*Alauda arvensis*); in 1879 Red-throated Divers (*Colymbus septentrionalis*) almost by the million; in 1880 countless numbers of the Pied Flycatcher (*Muscicapa atricapilla*); but none of these hosts, so far as was observed, came to England. Other writers besides Herr Gätke have insisted on the importance of wind in its relation to migration, while, by some who have other theories, it has been curiously ignored. By Mr. John Cordeaux its influence was recognized years ago. Writing from the Humber-mouth in 1881, he laid down as an axiom that, "with southerly or westerly winds, not amounting to gales, normal migration [to the east coast in autumn] is the rule, but with winds in the opposite direction the results are very opposite" ('Third Report on the Migration of Birds,' p. 39). Subsequently he seems to have modified his opinions a little as to direction.

Although, when I lived at Cromer, my attention, like Mr. Cordeaux's, used to be directed to all kinds of birds, I exercised special supervision on Gulls (Laridæ), particularly the Herring and Lesser Black-backed Gulls (*Larus argentatus* and *L. fuscus*), the most plentiful and the easiest to watch. I think it will be shown that these Laridæ give a key to what obtains in most other birds, for the wind which suits them,—and I shall show presently that in autumn it is always a contrary wind,—is most acceptable to all species under similar conditions.

To what extent the Laridæ are really birds of passage over the North Sea it would be hard to say, but it has been over and over again remarked that, as regularly as autumn comes round, great numbers of them, chiefly of the two species just named, are to be seen at Cromer *passing along the shore and always flying west*. Many have been the surmises as to their destination and why they should almost invariably adopt the same course and go in the same direction, and several times I have corresponded with Mr. John Cordeaux about this subject. It is fortunate that on the coast of Lincolnshire there should be a naturalist who for a long period of years has made the migration of birds a close study. In 1884 both

Mr. Cordeaux and I, being on the look-out, observed, though not simultaneously, a very great migration of Gulls (albeit the word "migration" is not altogether applicable)—he in Lincolnshire and I in Norfolk. Mr. Cordeaux had his attention drawn to the movement, for that is a better expression, on September 25th, and from that day to the 28th he and his friends were absorbed spectators of very great numbers of Herring- and Lesser Black-backed Gulls flying in the teeth of a strong south-west wind. The passage lasted four days, ten hours each day, and possibly during the night also (see the account of it in the Sixth Report on Migration, p. 65).

A fortnight later, October 11th, very nearly the same thing was to be seen in Norfolk. On that day one of the largest flights passed Cromer and the adjacent village of Overstrand. There had been a very high wind, in fact a gale, in the night from north-north-west, and at 11 A.M. not a single Gull was visible from the cliff. When the great flight or passage of Gulls began I cannot say, but it certainly must have commenced soon after 11 A.M. I did not go to the shore again from that time until 3 P.M., when the wind was still blowing from the west, but greatly moderated, and numbers of Gulls were passing. How many hours they continued going by I do not know; but if they continued filing past for nine hours, 11,880 must have gone by. This is reckoning that a flock passed every minute, and that the average number in a flock was twenty-two. They were chiefly young Herring-Gulls and Lesser Black-backs with some Common Gulls (*L. canus*) and a few adult Great Black-backs (*L. marinus*), and now and then a Black-headed Gull (*L. ridibundus*). All were going in the same direction, west-north-west. The next day the wind was in much the same quarter, but the Gulls had all disappeared. On the 10th (the day before this great flight) the wind had been from the north; on the 9th I believe it was north or north-west, but am not sure, and on the 8th north-north-west. On the 7th it was north-north-east—that is, straight on shore at Cromer, so that Gulls would have no advantage whichever way they went, and accordingly only three were seen; but these three

were going in the customary direction, viz. westwards, against the wind.

On the 26th of the same October great numbers of Gulls were again flying west, as before, and, being desirous of gaining an accurate notion of their numbers, I stood for two hours by my watch on the shore at Overstrand and counted them roughly as they passed. In the first hour, commencing at 3.20 P.M., as near as I can say, about 415 passed; in the second hour about 345 passed. They were very close to the shore, and consisted of the same species as before, and were nearly all in flocks of from ten to twenty, but Common Gulls preponderated, with many young Herring-Gulls and Black-backs. At 5.30 their regiments were still defiling past as steadily as ever, and every little company took exactly the same course. How long this had been going on it is impossible to say, but probably from early in the morning, as the wind had been high, and there is every reason to suppose that they continued passing far into the night. The wind was north-north-west. The next day it was still in the same quarter, but there were no Gulls,—for the time they had all passed*.

The following day, October 28th, the wind shifted to west-north-west and blew hard, and Mr. Cordeaux registered a great flight of Woodcocks. Fresh relays of Gulls had come up and were all going west as before. Probably from 2000 to 3000 passed on that day, and pretty nearly 5000 on the 26th. It is a speculation in my mind whether those on the 28th were the same individuals which passed on the 26th or others. The former theory may be accepted on the supposition that they had occupied the 27th in making the return journey, which would have been in an easterly direction, far out to sea; but in that case they must have gone with the wind, which it is quite certain they do not like to do. On the other hand, if they were fresh individuals they had probably come from the shores of Essex and Kent, or

* Some account of this "migration," and other notes on the same subject, will be found in the Norfolk and Norwich Nat. Soc. Trans. iv. p. 326, and in the appendix to Rye's 'History of Cromer.'

from Belgium, and the hundred miles of sea between would furnish its contingent to the army.

Besides the occasional appearance of Gulls in these great numbers, as in the two instances which have just been related, there may be seen almost every day throughout October and November at Cromer single Gulls and Gulls in twos and threes, and if the wind be west, so invariably is the direction of their flight the same. As a rule they fly high in fine weather and low in bad weather, but be it high or low they always go towards Blakeney, which is a small town and harbour further west, beyond which again is Wells, with wide "binks" and flats, where Col. Feilden has sometimes seen large numbers sheltering themselves.

To show how frequent westerly winds are on the east coast of England, it is only necessary to refer to the meteorological table annually contributed to the 'Transactions of the Norfolk and Norwich Naturalists' Society' by Mr. A. W. Preston, in which the direction of the wind is noted from the vane on the spire of Norwich cathedral. In 1883 we had in Norfolk 173 days of west wind, in 1884 165; but I prefer to give, for comparison, eight years in a tabular statement, as a sample of what generally takes place.

1883	W. 173 days.	1887	W. 186 days.
1884	W. 165 „	1888	W. 171 „
1885	W. 147 „	1889	W. 180 „
1886	W. 170 „	1890	W. 191 „

Nor is the west wind confined to England alone: all round the globe it is the prevailing wind north of lat. 30°, and doubtless the Gulls of the Atlantic often fly against it or commit themselves to its mercy and allow themselves to be whirled away with it. Mr. Harvie-Brown says west wind was unusually prevalent in Scotland in 1884, when I saw this great "migration" or westward movement. From lat. 30° southwards to the equator north-east winds prevail round the globe, and probably the direction of flight is reversed by these birds, which, it may be, go east when they get into these "trade winds." Birds of any kind seldom cross

the North Sea to Norfolk in spring, which is just what we should expect, because in the months of April and May we have not much west wind—see Mr. Preston's tables before referred to.

It may be laid down as a law that the direction of the wind is the key to the movements, not only of Gulls, but of all birds which migrate at a low altitude, and especially those

Tracks of birds flying against a west wind.

which journey by day, such, for example, as *Corvus cornix*, *C. frugilegus*, *C. monedula*, *Alauda arvensis*, *Fringilla cœlebs*, *Sturnus vulgaris*, *Scolopax rusticula*, *Accipiter nisus*, and *Falco tinnunculus*. These and many others in Norfolk, and especially near the coast, prefer in autumn to go against the wind if it is not too strong, and generally do so. The annexed map will make my meaning more plain, as it shows

the wind from the west, the bending outline of our coast, and the course taken by the Gulls. When these have flown as far as the salt water goes, I believe they generally settle in such estuaries as the Humber-mouth, the Wash, and the mouth of the Thames; but land-birds, *e. g.* Crows and Larks, indicated on the map by the larger dots, go inland, still, in most cases, flying against the wind.

In my humble opinion it is the west winds of autumn which bring the Pectoral Sandpiper (*Tringa maculata*), Sabine's Gull (*Xema sabinii*), and many other North-American birds enumerated in Saunders's Manual—especially among the Scolopacidæ—to the east coast of the British Isles, instead of landing them in Ireland, which is much nearer to the United States. Or, if Sabine's Gull does occur in Ireland, it is on the east side, as all the records show, where it has a wind to fly against. Certainly if it were not for the west wind there would not be that annual east-to-west autumnal migration which there is to Norfolk and on the east coast of England generally. The direction taken by the birds would be changed if the prevailing winds blew from any other quarter than west, for they like flying against it, account for it how we may, though it is not to be denied that there are now and then exceptions. But a cause for such may be guessed at, if sought for. If the birds did not fly against the wind they would often be carried away by it.

On the other hand, a gale of moderate strength, from whatever quarter, has a very different effect, bearing all the sea-birds and land-birds alike before it if strong, and for the smaller land-birds a very slight puff will suffice. The memorable flight of Blue-throats (*Cyanecula suecica*) to the coast of Norfolk in September 1884 was considered by those on the spot to be immediately after an east wind increasing in force and very gusty, which the Blue-throats must have flown with, and not against. The vast incursion of Gold-crests (*Regulus cristatus*) in the autumn of 1882, which extended far beyond the limits of Norfolk, and was "like a

snowstorm" in Heligoland, was pretty clearly shown to be owing to high winds from the east. The 60 Little Gulls (*Larus minutus*) recorded by the late Henry Stevenson in 1870 were drifted in before the violence of a north-east gale, and so were the Pomatorhine Skuas (*Stercorarius pomatorhinus*) in October 1879. Gales like these, and hurricanes like that described by Mr. A. C. Chapman in 'The Naturalist' for February 1886, must be taken into account by those who would study the movements of birds; but these phenomena somewhat complicate the subject of migration, and, by their irregularity, make the problem more difficult to be understood.

It may be broadly said that the two great factors in avian migration are the direction of the wind and food; and of these the former is much the more potent, inasmuch as wind continually retards migration a good deal more than it helps it. Few will be found to deny that birds on migration move fast or slow according to its velocity, and certainly they move on or go backwards according to its direction. Before long the wind drops, and the wished-for night of stillness comes, which, to the smaller feathered pilgrims especially, must be most welcome. Then, as Herr Gätke tells us —in the results of a life's observation now for the first time made accessible to English readers—they rise high in air, often probably to an immense height, and speed away south at one hundred miles an hour (Swallows are said to do 200), and in nine hours they are in Africa.

This is evidently what happens to the multitudes of Scandinavian migrants which come across the North Sea to the British Isles in autumn. If they always continued flying west they would find themselves in the Atlantic (and a recent case was mentioned in 'The Field' newspaper in which that actually happened to some Rooks), but they wait their opportunity and then they go south.